

TYPIFICATION, TAXONOMY, AND A NEW SUBSPECIES OF *POLYGONUM SAWATCHENSE* (POLYGONACEAE) FROM NORTH AMERICA

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ABSTRACT

A new subspecies of *Polygonum sawatchense* Small is described and illustrated for the forthcoming treatments of the genus *Polygonum* (Polygonaceae) in Flora of North America and Jepson Manual, Flora of California: *Polygonum sawatchense* subsp. *oblivium*. *Polygonum sawatchense* is typified and its taxonomy and distribution in North America are discussed.

RESUMEN

Se describe y se ilustra una nueva subespecie de *Polygonum sawatchense* Small para los futuros tratamientos del género *Polygonum* (Polygonaceae) en la Flora de Norteamérica y el Jepson Manual, Flora de California: *Polygonum sawatchense* subsp. *oblivium*. *Polygonum sawatchense* se ha tipificado y se discute su taxonomía y distribución en Norteamérica.

INTRODUCTION

Small (1893) described *Polygonum sawatchense* from some specimens collected by Katherine Brandegees in Sawatch Range, Colorado, U.S.A., and deposited in CAS. When Hickman (1984) proposed to treat this species at subspecific rank within *P. douglasii* Greene, he observed that these collections were presumably destroyed during the earthquake and fire of 1906. He did not propose a lectotype or neotype and instead adopted the epithet of the heterotypic *P. douglasii* var. *johnstonii* Munz, calling the subspecies *P. douglasii* subsp. *johnstonii* (Munz) J.C. Hickman (Hickman 1984). He thus cited the holotype of *P. douglasii* var. *johnstonii* when he made the new combination *P. douglasii* subsp. *johnstonii* (Hickman 1984). However, based on his annotations from various herbaria (e.g. CAS, DS, UC, RSA) later Hickman considered plants that agree morphologically with the type of *P. douglasii* subsp. *johnstonii* to be “intermediates between *P. douglasii* subsp. *douglasii* and subsp. *johnstonii*,” whereas the type of *Polygonum douglasii* var. *johnstonii* published by Munz (1935) is actually within the range of variation of typical *P. sawatchense* Small. In fact, Hickman (1993) shifted the meaning of *P. douglasii* subsp. *johnstonii* to an undescribed taxon. During the preparation of the accounts of *Polygonum* s.str. for Flora of North

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America and the forthcoming revision of the Jepson Manual, Flora of California, it was concluded that *P. sawatchense* should be accepted at the specific rank. Plants that were referred to by Hickman (1993) as "*P. douglasii* subsp. *johnstonii*" are described here as a new subspecies, *P. sawatchense* subsp. *oblivium*.

MATERIAL AND METHODS

Descriptions and details of distribution of taxa are based on collections from: A, ALTA, CAS, DAO, DC, DS, GH, F, JEPS, LL, MT, MTMG, NY, OAC, POM, QFA, RSA, SASK, TEX, UBC, UC, USAS and US. Stem papillae are easily observed on young stems or toward apices of mature stems and branches, at magnifications higher than 50. Measurements of leaves, ocreae and petioles were made at the middle of the main stem. The state characters, "flowers closed" and "flowers wide-open" were observed on herbarium specimens. However, it should be noted that in fruit, flowers are always closed. Description of perianth refers to the fruiting perianth, which was measured from the joint with the pedicel. Pictures were taken with a Scanning Electron Microscope Hitachi S-570 at 15 KV. Samples were collected from herbarium specimens within the holdings of GH, NY and RSA; these collections were indicated with a "*" in the lists of representative specimens examined. Samples were coated with 30 nm gold using an Emitech K 550 Sputter Coater.

Typification of *Polygonum sawatchense*

A specimen collected by Brandegee from the Sawatch Range, Colorado is deposited in NY (00323810!), but it was not cited by Small (1893) in the protologue and, furthermore, it is damaged. A neotype is designated below from one of the specimens cited one year later by Small (1894) as "nearly like the original in every respect."

Taxonomy

Hickman (1984) proposed a new taxonomic concept for *P. douglasii* by including within it five other species: *P. sawatchense*, *P. spergulariaeforme* Meisn. ex Small, *P. majus* Meisn., *P. nuttallii* Small and *P. austiniae* Greene. Hickman (1984) justified these new combinations by the intermediate patterns of variation he observed between some of the taxa: "intermediates sometimes outnumber typical forms." For example, he reported such frequent intermediates between *P. douglasii* and *P. sawatchense* (Hickman 1984). However, even in this case Hickman admitted later that they "both may grow together without local intergradation" (Hickman 1993). We found that Hickman's intermediates (in herb.) are in most of the cases within the range of variation of each taxon, which has been poorly understood. *Polygonum sawatchense* is more variable than previously known and two subspecies, one of them formally undescribed, are recognized here. The two subspecies may partially intergrade in the areas of sympatry.

Polygonum sawatchense Small, Bull. Torrey Bot. Club 20:213, pl. 156. 1893. TYPE: U.S.A. Yellowstone Park, 1885, *T. Tweedy* s.n. (NEOTYPE, here designated: US!).

a. *P. sawatchense* subsp. *sawatchense* (Fig. 1a)

= *Polygonum douglasii* Greene var. *johnstonii* Munz, Man. So. Calif. Bot. 131:597. 1935; *P. douglasii* subsp. *johnstonii* (Munz) J.C. Hickman, Madroño 31:250. 1984.

Polygonum exile Eastw., Proc. Calif. Acad. Sci. Ser. 3, Bot. 2:286. 1902.

Polygonum triandrous Coolidge, Madroño 20:266. 1970.

Stems green to brownish, usually branched from base, 4–50 cm long, glabrous (Fig. 2a), with smooth faces and sometimes narrow winged angles. Leaves; ocreae glabrous; blades linear, narrow-oblong to oblanceolate, 15–45 × 2–8(–12) mm; margins usually revolute, glabrous (Fig. 2c); upper leaves abruptly reduced to scale-like bracts, or much longer than the flowers they subtend. Inflorescences axillary or of long, open spike-like racemes, 5–15 cm long; cymes (1–)2–4-flowered; bracts equalling, somewhat longer, or much longer than the flowers. Flowers closed; pedicels erect, 1–4 mm; perianth (2.5–)3–3.5 mm, the tube 25–40% of the perianth length, the tepals naviculate (Fig. 2e), greenish or reddish with white or pink borders, with midveins unbranched or with a few branches at base. Stamens 3–8; anthers pink to purple, 130–160 μm long. Achenes black, trigonous, 2.5–3 mm, ovate or elliptic, smooth.

Distribution and ecology.—CANADA: Alberta, Saskatchewan. U.S.A.: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, South Dakota, Utah, Washington, Wyoming. MEXICO: Baja California. It grows in dry meadows, pastures, sagebrush and forests on sandy, gravelly or rocky substrates. Flowering Jun–Aug.

It is important to emphasize that narrow-leaved plants regarded by Hickman as intermediates between *P. douglasii* subsp. *douglasii* and his “subsp. *johnstonii*,” belong in fact to *P. sawatchense* subsp. *sawatchense*. Even with this narrow circumscription, *P. sawatchense* subsp. *sawatchense* is variable. “Typical” *P. sawatchense* plants described by Small from the Rocky Mountains, Colorado are relatively dwarf, 6–15 cm tall, dull green-brownish with persistent leaves that gradually transform into leaf-like bracts, 3–5 times longer than the flowers they subtend. Plants described as *P. douglasii* var. *johnstonii* by Munz from San Bernardino Mountains, California are taller, to 50 cm, with caducous green-glaucous, basal leaves, sharply differentiated from the bracts, which are equal to or up to 3 times as long as the flowers they subtend. However, we found a continuous transition between these two extremes, and a further subdivision of *P. sawatchense* subsp. *sawatchense* is apparently not possible. Collections of Patterson (1885) from the Rocky Mountains, near Golden, Colorado illustrate very well this transition. For example, *Patterson 131* (UC, NY) collected from elevations ranging from 3000 to 3300 m is “typical.” Small himself observed that another collection (*Patterson 128*; NY, UC, US) from an elevation of 1800 m

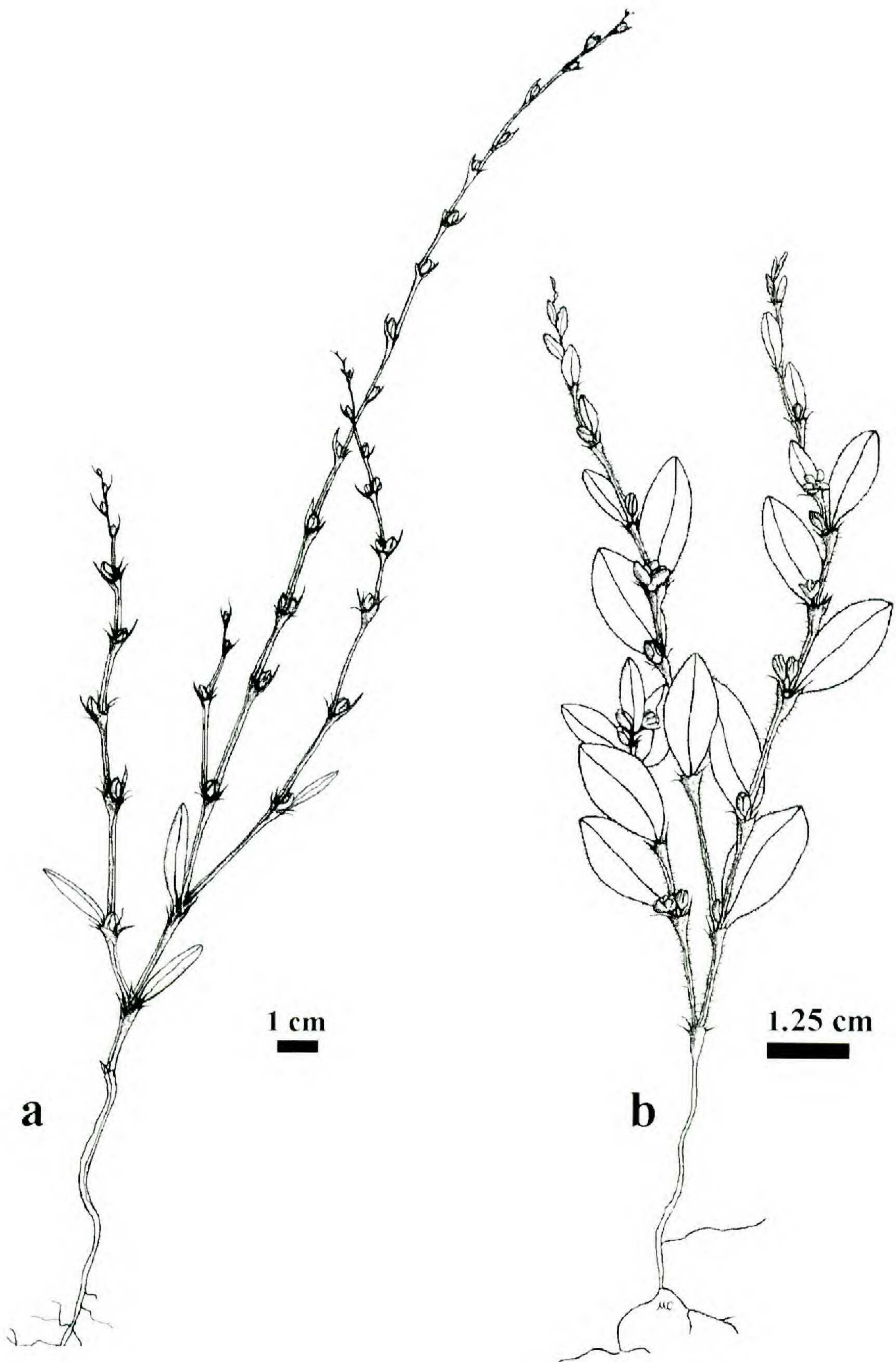


FIG. 1. *Polygonum sawatchense*, general habit; **a.** *P. sawatchense* subsp. *sawatchense*, based on P.A. Munz & M. Johnston 8506 (RSA), **b.** *P. sawatchense* subsp. *oblivium*, based on F.W. Oettinger 260 (RSA).

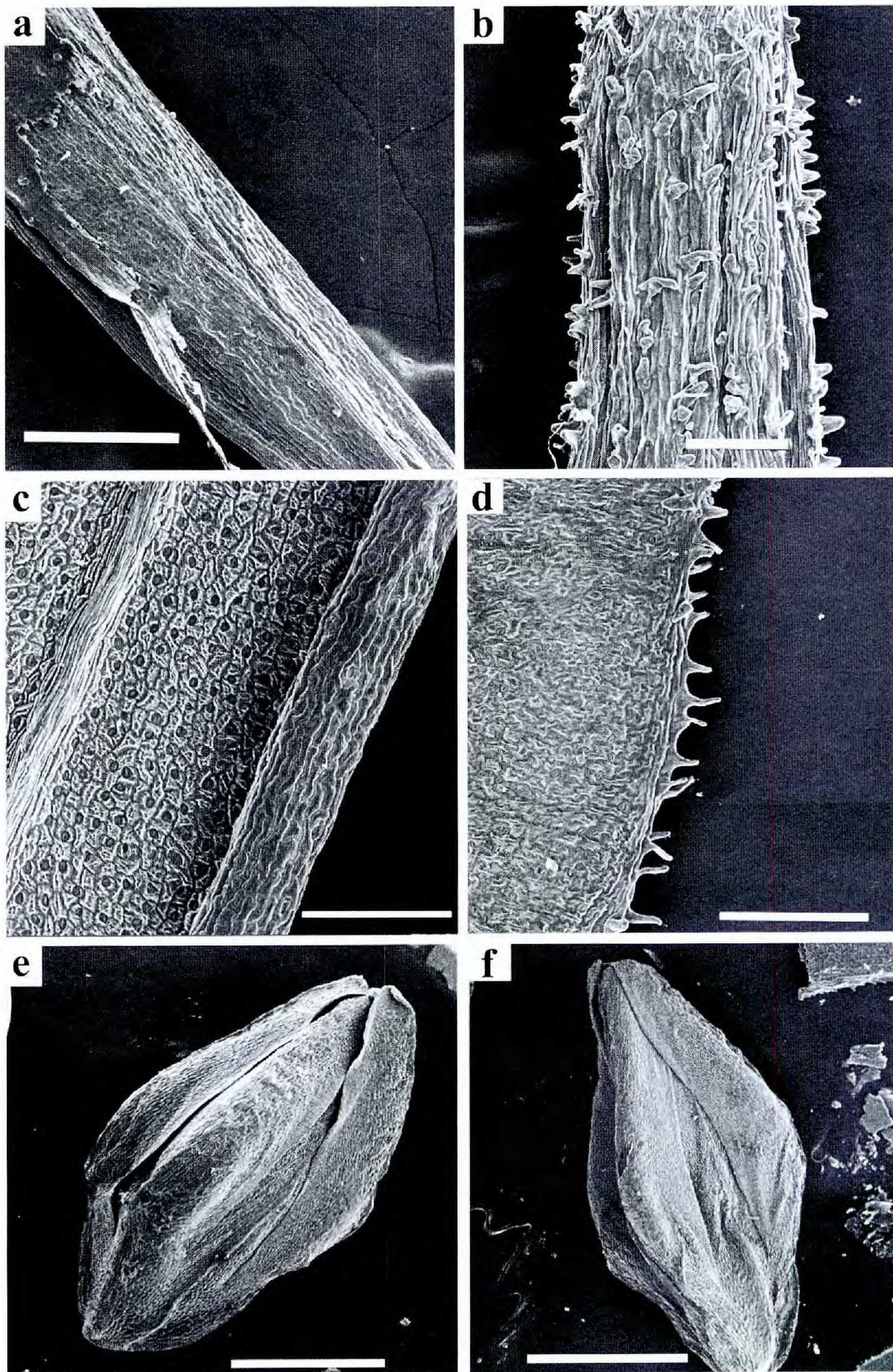


FIG. 2. **a–b.** Morphology of stem: **a.** *Polygonum sawatchense* subsp. *sawatchense* (scale bar = 0.5 mm), **b.** *P. sawatchense* subsp. *oblivium* (scale bar = 0.3 mm), **c–d.** Margin of leaves: **c.** *P. sawatchense* subsp. *sawatchense*, **d.** *P. sawatchense* subsp. *oblivium* (scale bar = 0.3 mm), **e–f.** Fruiting perianth: **e.** *P. sawatchense* subsp. *sawatchense*, **f.** *P. sawatchense* subsp. *oblivium* (scale bar = 1 mm).

“is more elongated and rather straggling” and that “this difference is most likely due to their unlike habitats and altitudes” (Small 1894).

Representative specimens examined. **CANADA. ALBERTA. Cypress Hills Region:** Chappice Lake, 23 Jun 1990, *J.H. Hudson 4921* (SASK). **SASKATCHEWAN. Moose Jaw Region:** Grasslands Park, 9 mi SE of Val Marie, 17 Jul 1989, *E.R. Hooper 11110* (USAS). **Swift Current Region:** Altawan, 49E14'30"N 109E55'W, 8 Jul 1999, *J.H. Hudson 5407* (SASK). **U.S.A. ARIZONA. Apache Co.:** 3.5 mi E of McNary, roadside, ponderosa pine forest, 13 Aug 1974, *D.J. Pinkava 12343 et al.* (US, NY). **Coconino Co.:** Buch Springs Ranger Station, 7500 ft, Sep. 1936, *R.E. Collom 599* (US); Flagstaff, 2 Aug 1884, *M.E. Jones 3957* (RSA*). **Cochise Co.:** Chiricahua Mountains, Coronado National Forest, S base of Barfoot Peak, 8200 ft, 4 Sep 1983, *D. Ward & D. Peterson s.n.* (RSA*); road to Rustler Park, 7600 ft, 14 Oct 1943, *T.H. Kearney & R.H. Peebles 15104* (UC). **Gila Co.:** Workman Creek Canyon, near end of car road, Sierra Ancha Mountains, 5500 ft, 27 Aug 1946, *F.W. Gould 3734* (GH). **Greenlee Co.:** Apache National Forest, 13 mi S of Strayhorse Campground, just N of Blue Lookout, ponderosa pine, 24 Jul 1973, *D.J. Pinkava 11280A et al.* (US, NY). **CALIFORNIA. Fresno Co.:** Hutchinson Area, Piute Canyon, 10 mi E Florence, 12100–12500 ft, 18 Aug 1955, *C.H. Quibell 5847* (RSA). **Inyo Co.:** Head of Wyman Canyon, White Mountains, 10000 ft, 19 Jul 1955, *P.A. Munz 21043* (RSA). **Lassen Co.:** Harvey Valley, 9 Jul 1934, *J.T. Howell 12528* (GH, RSA*). **Modoc Co.:** NW side of Bidwell Mountain, 2.8 mi N of 8 mi creek on the road from Lake Annie, 30 Jun 1984, *A. Tiehm 8841* (RSA); Duncan Horse Camp, 1 Jul 1934, *J.T. Howell 12317* (GH, NY). **Mono Co.:** Sweetwater Mountains, site of Star City, 8500 ft, 12 Jul 1975, *M. DeDecker 3958* (RSA); Sierra Nevada, Little Lake, 3300 m, 20 Jul 1969, *M. DeDecker 2183* (RSA). **Nevada Co.:** Dog Valley, 5500 ft, 30 Jun 1913, *A.A. Heller 10897* (JEPS, NY, US). **Riverside Co.:** Santa Rosa Peak, Virgin Springs, 7500 ft, 14 Aug 1938, *P.A. Munz 15359* (RSA*). **San Bernardino Co.:** San Bernardino Mountains, bellow Dollar Lake, 8700 ft, 22 Aug 1922, *P.A. Munz 6190* (RSA*, UC). **Tulare Co.:** Head of Monache Meadows on S Fork of Kern River, 8050 ft, 13 Jul 1950, *P.A. Munz 14994* (RSA); Mineral King, 8000 ft, 19 Jul 1951, *L.S. Rose s.n.* (RSA, UC). **Ventura Co.:** Pinos Mountain, 8400 ft, 30 Jul 1922, *F.W. Peirson 3223* (RSA). **COLORADO. Conejos Co.:** 7 mi N of Conejos Campground, NW of Antonito, 19 Jul 1952, *W.A. Weber 7862* (RSA*). **Grant Co.:** Rocky Mountain National Park, 2.25 mi WSW of Mount Bryant, granite soil origin, 8500 ft, 4 Aug 1936, *Sawyer & Rutter 118b* (UC). **Gunnison Co.:** 3 mi N of Almont, on road to Crested Butte, 8500 ft, 2 Aug 1955, *W.A. Weber 9376* (GH, RSA, UC). **Larimer Co.:** Moraine Park, 11 Aug 1925, *G.E. Osterhout 6464* (RSA*). **Montezuma Co.:** Mesa Verde National Park, near Cedar Tree Tower ruins, ca. 7100 ft, 26 Jul 1949, *H. Bailey & V. Bailey 3106* (UC). **Rio Grande Co.:** West Fork San Francisco Creek, Del Norte Ranger District, Rio Grande National Forest, 7 Aug 1984, *B.H.M. Mooers 437* (NY). **IDAHO. Blaine Co.:** Ketchum, 5877 ft, 20 Jul 1911, *A. Nelson & J.F. Macbride 1246* (RSA). **NEVADA. Clark Co.:** Charleston Mountains, Charleston Park, 2270 m, 29 Jul 1938, *I.W. Clokey 7901* (GH, NY, RSA*, UC); Pipeline Canyon to Rainbow Falls, E of Cathedral Rock, Charleston Mountains, 8200 ft, 30 Jul 1938, *P. Train 243* (GH, NY, UC). **Elko Co.:** Lamoille Canyon, Ruby Mountains, 20 Jul 1938, *F.W. Pennell & R.L. Shaffer 23307* (GH). **Humboldt Co.:** Pine Forest Range, 11 mi N of Leonard Creek Ranch, 6400 ft, 27 Jun 1964, *N.H. Holmgren & J.L. Reveal 1120* (GH, NY, RSA*, UC). **Mineral Co.:** Cottonwood Creek Canyon, 4 mi below Laphan Meadows Mountain, Grant Rd., 7800 ft, 22 Jun 1940, *P. Train 4109* (NY, UC). **Nye Co.:** Pine Creek Canyon, frequent, gravelly sagebrush slopes, 20 Jul 1940, *B. Maguire & A.H. Holmgren 25861* (GH, NY, UC, US). **Washoe Co.:** 20 mi NE of Gerlach, 5500 ft, 20 Jun 1942, *C. McMillan & K.H. McKnight 147* (NY). **NEW MEXICO. Catron Co.:** between Luna and the Arizona border on Hwy. 180, 14 Aug 1973, *R. Spellenberg & M. Spellenberg s.n.* (NY). **Chaves Co.:** Roswell, 21 May 1931, *A. Nelson 11587* (UC). **Colfax Co.:** vicinity of Ute Park, 2200–2900 m, 26 Aug 1916, *P.C. Standley 13847* (US). **Grant Co.:** Piños Altos Mountains, 24 Sep 1931, *M.E. Jones 28608* (RSA). **Lincoln Co.:** White Mountains, 7400 ft, 25 Aug 1907, *E.O. Wooton & P.C. Standley s.n.* (US). **McKinley Co.:** Zuni Mountains, 8 mi E of Hwy. 32 on road to McGaffey inside Cibola National Forest, 16 Aug 1973, *R. Spellenberg & M. Spellenberg s.n.* (NY). **San Miquel Co.:** T. M. O'Connor Ranch, South Rim Pasture, 6900 ft, 1.5 mi E of Las Vegas, 28 Jul 1984, *S.A. Hill 14631* (NY, RSA*). **Taos Co.:** Apache Springs, Apache Peak, Carson

Forest, 3000 m, 22 Aug 1923, W.W. Eggleston 19162 (US). **Valencia Co.:** Mount Taylor, San Mateo Mountains, College experimental area, 20 mi E of Grants, 8300 ft, 4 Sep 1935, K.F. Parker 2333 (RSA*). **UTAH. Grand Co.:** Uintah and Ouray Indian Reservation, 59 mi S of Ouray, along Weaver Reservoir Rd., 8500 ft, 30 Jul 1965, N.H. Holmgren et al. 2309 (GH, NY). **Juab Co.:** Ridge above junction of Nebo Loop Rd. and Salt Creek Rd., 6400 ft, 1 Jul 1983, K. Thorne & J. Thorne 2523 (NY). **Salt Lake Co.:** Big Cottonwood Canyon, 8000 ft, 17 Aug 1941, J.F. Brenckle et al. s.n. (GH, NY, US). **San Juan Co.:** S side of Abajo Mountains, 2000–2500 m, 28–29 Jul 1911, P.A. Rydberg & A.O. Garrett 9270 (NY, US). **Washington Co.:** Pine Valley Mountains, 6760 ft, 2 Aug 1967, J.L. Gentry Jr. 2256 (NY); Zion National Park, East Rim trail, Echo Canyon, 11 Jul 1949, H. Bailey & V. Bailey 3537 (UC). **WYOMING. Crook Co.:** Bear Lodge Range, Reuter Canyon, 5 mi N of Sundance, 5800 ft, 12 Jul 1960, C.L. Porter & M.W. Porter 8374 (RSA*, UC). **Fremont Co.:** Togwotee Pass, 26 Jul 1939, J.F. Brenckle 39-139 & S.D. Mellete (RSA, NY, UC, US). **Natrona Co.:** Southern Powder River Basin, 10 mi SW of Waltman along Powder River, 6400 ft, 6 Jul 1993, R.L. Hartman 40486 (UC). **Weston Co.:** Black Hills, Elk Mountain Area, Clifton Canyon, above Last Canyon, 4700 ft, 8 Aug 1984, H. Marriott 8809 (NY). **MEXICO. BAJA CALIFORNIA:** Sierra, San Pedro Martir, Dead Horse Meadow, SW end of Venado Blanco, 17 Jul 1988, S. Boyd 2628 et al. (RSA*); Vallecitos Meadow, 2400 m, 26 Aug 1973, R. Moran 21127 (RSA).

b. *Polygonum sawatchense* subsp. *oblivium*, Costea & Tardif, subsp. nov. (**Fig. 1b**). TYPE: U.S.A. CALIFORNIA. Siskiyou Co.: Salmon Mountains, High Lake Basins in the vicinity of English Peak, Marble Mountain Wilderness Area, gully near meadow SE of Tom Taylor Cabin, elevation 6700 ft, 13 Aug 1967, F.W. Oettinger 260 (HOLOTYPE: RSA).

Polygonum douglasii subsp. *johnstonii* auct.

Polygonum sawatchense subsp. *sawatchense* affinis sed caulis scabri-papillosus et foliis oblongi-ellipticis vel ellipticis, marginibus papilloso-denticulatis differt.

Stems green, simple or with a few branches from base, 5–15(–25) cm long, papillose scaberulous on and between ribs; papillae white, patent, dense, conical-cylindrical, 90–150 μ m long (Fig. 2b). Leaves; ocreae 4–10 mm, scaberulous, with the free part lacerate or disintegrating into a few fibers; blade elliptic to oblong-elliptic, gradually decreasing in size upwards and persistent at flowering-fruiting stage, 8–20(–25) \times 5–10 mm, acute at both ends; margins plane, papillose-denticulate; papillae similar to those present on the stems (Fig. 2d). Inflorescences mostly axillary or if a terminal spiciform raceme present, then less than 5 cm long; cymes 1–3(–4)-flowered. At least some flowers wide-open; pedicels 1–3 mm. Perianth 3–4 mm, the tube 20–30% of the perianth length, tepals oblong-elliptic, cucullate, naviculate and overlapping (Fig. 2f), greenish-white or greenish-yellow (sometimes flushed with purple) with white borders the mid-veins greenish or brown, usually branched at base. Stamens 8; anthers pink to purple, rarely whitish, 130–200 μ m. Achenes black, trigonous, 2.6–3.3 mm, elliptic to elliptic-ovate, smooth.

Distribution and ecology.—CANADA: British Columbia. U.S.A.: California, Idaho, Nevada, Oregon and Washington. It has the same ecology as subsp. *sawatchense*, but unlike the latter may also grow in shaded or moist places. Flowering Jun–Aug.

This taxon has been usually referred to as *P. douglasii* subsp. *johnstonii* (e.g.

by Hickman 1993). The protologue of *P. douglasii* var. *johnstonii* indicates only that it has erect pedicels, 1 mm long (Munz 1935). Hickman (1984) studied the holotype of *P. douglasii* var. *johnstonii* from RSA (Munz & Johnston 8506) when he included *P. sawatchense* within his new subspecies of *P. douglasii*. He noted: “the type shows several features of subsp. *douglasii* but it is closer to the extreme of subsp. *johnstonii* so the latter epithet can be retained at subspecific rank” (Hickman 1984). However, only almost 10 years later, in the Jepson Manual (1993) did it become apparent what Hickman understood by “subsp. *johnstonii*.” He described this taxon as having “persistent leaves, all elliptic” (Hickman 1993). This intrigued us because Munz’s holotype has caducous, narrow, oblong-lanceolate leaves. Even Munz specified later (Munz & Keck 1968) that, except for the erect and short pedicels, *P. douglasii* var. *johnstonii* is like *P. douglasii* (var. *douglasii*), namely with narrow, oblong-lanceolate leaves. Apparently, Hickman changed the original meaning of this name, from the plants of Munz, which are within the range of variation of typical *P. sawatchense*, to a taxon that has not been formally described. These plants are called here *P. sawatchense* subsp. *oblivium*. This confusion induced Hickman to consider plants of *P. douglasii* with broad leaves (var. *latifolium* Greene), as well as typical plants of *P. sawatchense*, to be intermediates “between subsp. *douglasii* and subsp. *johnstonii*” (Hickman, in herb.).

The stems of *Polygonum sawatchense* subsp. *oblivium* are scaberulous-papillose (Fig. 1b, 2b), the leaves are oblong-elliptic to elliptic (Fig. 1b), papillose-denticulate on the margins (Fig. 2 d) and the flowers, at least some of them, are open. *Polygonum sawatchense* subsp. *sawatchense* is entirely glabrous, the leaves are linear to oblanceolate (Fig. 1a, Fig. 2a, c), and flowers are normally closed. The tepal surface pattern of the two taxa is also different (Costea & Tardif, unpublished). Both subspecies occur in California, Idaho, Nevada and Washington. However, *P. sawatchense* subsp. *sawatchense* is more widely distributed, extending from Mexico, Arizona and New Mexico to Utah, Wyoming, Montana, South Dakota, North Dakota and Canada - Alberta and Saskatchewan. Although the two taxa are usually distinct, intermediate variation patterns may occur in the areas of sympatry, and this is why we treated them as subspecies. For example, glabrous plants with more or less broad and gradually decreasing leaves, as well as papillose-scaberulous plants with relatively narrow leaves, may be occasionally encountered.

Munz, who described *P. douglasii* var. *johnstonii* (1935), observed that this was different from *P. sawatchense* subsp. *oblivium*, but he usually identified the latter plants as *P. austinae* (e.g. Munz 18361, RSA). *Polygonum sawatchense* subsp. *oblivium* differs from *P. austinae* through its erect pedicels and much larger achenes. *Polygonum sawatchense* subsp. *oblivium* has also been frequently confused with *P. minimum*. They differ in respect to the morphology of leaves and ocreae, stems, size of fruiting perianth and achenes, as well as the pattern of

epicuticular wax sculpture of tepals (Costea & Tardif, unpublished). In particular, *P. minimum* has leaves that are hardly reduced distally, funnelliform ocreae, 1–4 mm long, papillae on stems and ocreae are conical, short, with a swollen base, and flowers and achenes are usually much smaller.

Representative specimens examined. **CANADA. BRITISH COLUMBIA:** Road up to Windy Joe, Manning Park, roadside, 4800 ft, 4 Aug 1957, *K. Beamish* 7856 (GH*, UBC). **U.S.A. CALIFORNIA. El Dorado Co.:** meadow near Fallen Leaf Lake, 21 Jun 1920, *A.M. Ottley* 822 (NY). **Humboldt Co.:** Grouse Mountain, gravelly moist flat, 5000 ft, 30 Aug 1933, *J.P. Tracy* 13023 (UC); 14 Jul 1935, *J.P. Tracy* 14042 (UC). **Modoc Co.:** common in dry forest openings; with *Abies concolor*, Northern Juniper Woodland, 7 mi North of Fort Bidwell, 6150 ft, 7 Jul 1955, *R.J. Weatherby* 1608 (RSA). **Nevada Co.:** Castle Peak, 31 Jul 1903, *A.A. Heller s.n.* (F, GH*, NY, RSA). **Plumas Co.:** Scattered annual growing in volcanic gravel with *Purshia tridentata*; Red fir forest, Bear Ridge near Taylor Lake; 7200 ft, 2 Jul 1955, *R.J. Weatherby* 1570 (RSA); ca. 0.5 mi below Red Rock lookout, ca. 8 mi S of Susanville, bare reddish gravel and outcrop between road and cliff, ca. 7000 ft, 3 Jul 1989, *B. Ertter* 8642 (UC). **Siskiyou Co.:** rocky summit, ridge road to Deadwood Lookout, mountains west of Yreka, 25 Jun 1952, *M. Ownbey & S.J. Preece, Jr.* 3345 (NY*); Salmon Mountains, open site northeast side of creek bed, Tom Taylor cabin, 6700 ft, 11 Aug 1968, *F.W. Oettinger* 471 (RSA); Paynes Springs, 2 mi SE from Medicine Lake, sandy shallow-soil basins on recent lava flows situated in *Abies magnifica* forest, 6550 ft, 26 Jun 1987, *D.W. Taylor* 9075 (UC); Grass Lake, 18 Jul 1948, *H.L. Mason* 13623 (RSA*, UC). **Truckee Co.:** 1/2 mi W of Lake Van Norden, 7000 ft, 22 Jun 1934, *N. French* 478 (RSA). **IDAHO. Elmore Co.:** W side Lava Mountain at headwaters of Russell Gulch, Boise National Forest N of Smith Prairie, sandy soil on granite, dry shade of forest, 7500 ft; 15 Jul 1981, *B. Ertter & J.W. Grimes* 4531 (NY, RSA*). **Valley Co.:** Dry slope 3 mi N and W of Payette Lake, 6000 ft, 25 Jun 1946, *C.L. Hitchcock & C.V. Muhlick* 13971 (NY). **NEVADA. Elko Co.:** among rock outcrops on hillsides above Maggie Summit, Bull Run mountains; with *Prunus* and *Amelanchier*; 6700 ft; 20 Jun 1980, *J.W. Grimes et al.* 1646 (NY*). **Humboldt Co.:** Sonoma Range, Water Canyon, sandy steep E facing slope with sagebrush; frequent, 6800 ft, 10 Jul 1964, *N.H. Holmgren & J.L. Reveal* 1374 (NY*); Jackson Range, ca. 50 mi WNW of Winnemucca; half way up road to mines at head of Jackson Creek, dry NW facing slope between streamlet and rimrock outcrops; 2100 m, 14 Jun 1987, *B. Ertter* 7146 *et al.* (RSA, UC). **OREGON:** Woods, Achoco Forest, 22 Jun 1932, *M.E. Peck* 17068 (NY*). **Grant Co.:** Malheur National Forest; Strawberry Mountain Wilderness, on Strawberry Mountain, woods of *Pseudotsuga*, *Abies grandis*, *Larix* and *Pinus*, 6500 ft, locally abundant on dry slopes, 12 July 1973, *M.F. Denton* 3188 (US); Aldrich Mountains, slopes between Fields Creek summit and Fields Peak, 5500 ft, 20 Jul 1962, *A.R. Kruckeberg* 5465 (UC). **Josephine Co.:** common in a neglected field, summit of the Siskiyou Mountains, yellow pine belt, 4500 ft, 21 Jun 1922, *A.A. Heller s.n.* (F, NY*); Oregon Caves, 6000 ft, 24 Jun 1934, *H.E. Parks* 4892 (UC). **Lake Co.:** dry flat under aspens and pines near meadow; Willow Creek Forestry Camp, Warner Mountains; 5800 ft, 24 Jun 1973, *P.A. Munz* 18361 (RSA*). **Maihew Co.:** Juniper Springs, 1350 m, 15 Jun 1896, *J.B. Leiberger* 2275 (UC). **WASHINGTON. Asotin Co.:** open slopes along ridge leading N of Big Butte on the breaks of the Grand Ronde River, 5000 ft, 3 Jun 1939, *F.G. Meyer* 1622 (GH*). **Okanogan Co.:** lower wooded slopes of Billy Goat Mountain, 4000 ft, 10 Jul 1934, *J.W. Thompson* 10891 (NY). **Wallowa Co.:** Ice Lake Trail, Wallowa Mountains, 26 Jun 1936, *A. Eastwood & J.T. Howell* (NY).

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